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February 15, 2007

Ms. Beverly T. Stepter, RPM
USEPA, Region 4
Waste Management Division
Sam Nunn Atlanta Federal Center, 11th Floor
61 Forsyth Street S.W. 3201
Atlanta, Georgia 30303

Subject: **Preliminary Human Health Risk Screening-Soils**
Henry's Knob Former Mine Site
York County, South Carolina
EPA ID No. SCN 000 407 376
MACTEC Project 3617-07-7106-1000

Dear Ms. Stepter:

As requested in our telephone conference call on Thursday, February 8, 2007, MACTEC Engineering and Consulting, Inc. (MACTEC), on behalf of ABB, Inc., has prepared the enclosed Human Health Risk Screening based on the laboratory analytical results of the soil samples collected during the Step 1 investigation at the subject site. We are providing you with five copies of the document.

MACTEC looks forward to working with you on this project and should you have any questions, please contact Paul S. Johnstone at (864) 288-5116.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

Eugene S. Shephard
Principal Engineer

by _____ with permission

Paul S. Johnstone, P.G.
Principal Geologist

Enclosure

cc: Mr. Tim Hornosky – SCDHEC, Columbia, SC (two copies)
Ms. Elaine Hammick – ABB, Inc., Windsor, CT
Mr. Eugene Shephard – MACTEC, Portland, ME
Mr. Jay Peters – MACTEC, Wakefield, MA
Ms. Gwen Geidel – University of South Carolina, Columbia, SC

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MACTEC

MACTEC, Inc. ☐
MACTEC Engineering and Consulting ☐
MACTEC Development ☐

MEMORANDUM

DATE:	**February 12, 2007**
FROM:	Jay Peters
SUBJECT:	**Human Health Risk Screening - Soil Data – Henry's Knob Former Mine Site**
TO:	Elaine Hammick
COPY TO:	File

The soil data collected in support of the Remedial Investigation (RI) for the Henry's Knob Former Mine Site (Site) were compared to various screening values in the Step 1 RI Report (MACTEC, 2006) to help place perspective on the significance of the detected concentrations and to help guide future site investigation activities. This memorandum provides additional discussion concerning potential risks to human health.

Table 3A of the Step 1 RI Report presented a comparison of analytical results for soil samples collected throughout the Site to USEPA Region IX Preliminary Remediation Goals (PRGs) for residential use soil, USEPA Region IX PRGs for industrial use soil, Piedmont background soil concentrations, and site-specific background soil concentrations. Table 3A is attached to this memorandum for reference.

The USEPA Region IX PRG values are risk-based soil concentrations that are protective for exposures to analytes in soil at specified target risk levels. The residential soil PRGs are protective for young children and adults who are assumed to ingest and contact soil, and inhale soil-derived dust, during activities such as gardening and playing on the ground, 350 days per year over a 30-year period. The industrial soil PRGs are protective for adults who are assumed to ingest and contact soil, and inhale soil-derived dust, during work-day activities, 250 days per year over a 25-year period. The PRG values used for soil data comparisons in Table 3A are considered to be PRG screening values because they are based on target risks below the EPA threshold risk criteria. Specifically, they are set at an excess lifetime cancer risk (ELCR) of 1 in 1 million ($1x10^{-6}$), which represents the lower bound, or point-of-departure, of the USEPA cancer risk range, and a target hazard index (HI) of 0.1, which represents $1/10^{th}$ the maximum acceptable risk level for non-carcinogenic health effects.

Collectively, the residential soil PRG screening values and site-specific background values are used to select chemicals of potential concern (COPCs). COPCs are the chemicals that could pose more than a negligible risk and are therefore quantitatively evaluated in the risk assessment. According to USEPA Region IV risk assessment guidance, chemicals are selected as COPCs if their maximum detected concentrations are greater than both the USEPA Region IX residential soil PRG screening value and the site-specific background value.

A review of the information presented in Table 3A indicates that seven inorganic analytes were detected at concentrations greater than the residential PRG screening values: aluminum, antimony, arsenic, iron, manganese, thallium, and vanadium. Of these analytes, aluminum, arsenic, and iron were detected at concentrations below the site-specific background values in all of the samples. Based on the soil data collected to date and presented in Table 3A, these three analytes would not be selected as COPCs in a risk assessment. Manganese and thallium were each detected in one sample at a concentration greater than the site-specific background value, and vanadium was detected in two samples at concentrations greater than the site-specific background values. Antimony was not detected in the Site-specific background data set, but the maximum detected concentration in samples collected from the Site is less than the background value for Piedmont soils. These analytes are further discussed in the context screening-level health risks.

Antimony. Antimony was detected at location SS-03-02 at a concentration (5 mg/kg) slightly above the residential soil PRG screening value of 3.1 mg//kg. If it was assumed that children and adults contacted soil at this location almost every day during play and outdoor activities, the HI would be only 0.17, which is well below the USEPA threshold HI of 1. This indicates that antimony at this location does not pose a health risk in excess of USEPA risk limits.

Manganese. Manganese was detected at location SS-02-02 at a concentration (830 mg/kg) above the residential soil PRG screening value of 180 mg/kg. If it was assumed that children and adults contacted soil at this location almost every day during play and outdoor activities, the HI would be only 0.46, which is well below the USEPA threshold HI of 1. This indicates that manganese at this location does not pose a health risk in excess of USEPA risk limits.

Thallium. Thallium was detected at locations SS-07-01-03, SS-08-01-02, and SS-09-01-02 at concentrations ranging from 4.5 mg/kg to 12 mg/kg, which are above the residential soil PRG screening value of 0.52 mg/kg. If it was assumed that children and adults contacted soil at each of these locations almost every day during play and outdoor activities, the HI values would range from 0.86 to 2.3. However, the HI associated with the Site-specific background value of 9.1 mg/kg (a HI of 1.8) is also greater than 1. For all of the soil samples except SS-08-01, the risk associated with exposure to thallium at the background locations is greater than the risk associated with exposure to thallium in samples collected at the Site. For sample SS-08-01, the

incremental risk, which is the risk that is over and above the risk associated with the natural background conditions, is 0.5, which is below the threshold HI of 1. It is notable also that the maximum concentration of thallium in the Site-specific background soil data set (14 mg/kg) is higher than the maximum concentration detected in soil samples collected at the Site. Collectively, this suggests that risks associated with thallium in soil samples collected at the Site are not distinguishable from risks associated with soil samples collected at background locations.

Vanadium. Vanadium was detected at the majority of locations at concentrations above the residential soil PRG screening value of 7.8 mg/kg, ranging from 8.2 mg/kg to 200 mg/kg. If it was assumed that children and adults contacted soil at these locations almost every day during play and outdoor activities, the HI values for all but five of the locations would be below 1. However, the HI associated with the Site-specific background value of 150 mg/kg (a HI of 1.9) is also greater than 1. For all of the soil samples except SS-02-02 and SS-02-05, the risk associated with exposure to vanadium at the background locations is greater than the risk associated with exposure to vanadium in samples collected at the Site. For samples SS-02-02 and SS-02-05, the incremental risk, which is the risk that is over and above the risk associated with the natural background conditions, are HI values of 0.64 and 0.13, respectively, which are below the threshold HI of 1. It is notable also that the there is only one sample collected at the Site with a concentration greater than the maximum detected vanadium concentration in the Site-specific background soil data set (170 mg/kg). Collectively, this suggests that risks associated with vanadium in soil samples collected at the Site are not distinguishable from risks associated with soil samples collected at background locations.

JP

Attachments

Table 3A
AOC Soil Analytical Results vs. Human Health Screening Values
Step 1 RI Implementation
October 2005
Henry's Knob Former Mine Site
York County, South Carolina

Sample ID	Cyanide-Total mg/kg	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Thallium mg/kg	Vanadium mg/kg	Zinc mg/kg
SS-01-01X00XX	< 0.59	4,500	< 0.29	2.9	71	< 0.23	< 0.12	< 290	7.8	5.3	78	48,000	6.5	< 290	22	< 0.097	< 2.3	< 290	< 0.29	< 0.29	< 290	< 0.59	37	< 7.7
SS-01-02X00XX	< 0.64	710	< 0.32	4.7	26	< 0.26	< 0.13	< 320	1.2	314*	12	29,000	1.8	< 320	11	< 0.11	4.4	< 320	219*	0.55	< 320	< 0.64	9.6	< 3.2
SS-01-03X00XX	< 0.52	880	< 0.26	5.4	67	< 0.21	< 0.10	< 260	3.6	< 1.4	7.2	27,000	2.3	< 260	< 0.78	< 0.085	< 2.1	< 260	10.9	< 0.26	< 260	< 0.52	22	< 2.6
SS-01-05X00XX	< 0.53	1,000	< 0.26	1.6	91	< 0.21	< 0.10	< 260	1.8	< 1.4	9.2	19,000	2.6	< 260	4.7	< 0.086	< 2.1	< 260	5.4	< 0.26	< 260	< 0.52	14	< 3.0
SS-01-06X00XX	< 0.74	12,000	< 0.37	5.0	130	0.34	< 0.15	< 370	10	< 1.9	38	52,000	2.2	< 260	6.4	< 0.087	< 2.1	< 260	4.0	< 0.26	< 260	< 0.53	10	< 2.7
SS-02-01X00XX	< 0.54	2,100	< 0.27	2.3	70	< 0.22	< 0.11	< 270	5.5	1.7	15	19,000	1.9	< 270	6.6	< 0.09	< 2.2	< 270	5.4*	< 0.27	< 270	< 0.54	27	4.0
SS-02-02X00XX	< 0.61	41,000	< 0.31	2.8	44	0.77	< 0.12	< 310	34	29*	79	66,000	8.4	680*	530*	< 0.10	9.5	560	3.6	< 0.31	< 310	< 0.61	200*	31*
SS-02-03X00XX	< 0.55	7,100	< 0.28	2.7	39	0.22	< 0.11	< 280	9.5	3.3	23	35,000	3.3	< 280	43	< 0.092	< 2.2	< 280	6.0*	< 0.28	< 280	< 0.55	59	5.7
SS-02-04X00XP	< 0.64	15,000	< 0.32	3.7	66	0.37	< 0.13	< 320	12	< 1.7	30	50,000	6.1	< 320	41	< 0.11	< 2.6	360	5.0*	< 0.32	< 320	< 0.64	89	7.8
SS-02-04X00XX	< 0.64	17,000	< 0.32	4.0	61	0.42	< 0.13	< 320	13	< 1.6	34	46,000	6.9	< 320	49	< 0.10	2.6	410	5.5*	< 0.32	< 320	< 0.64	110	9.3
SS-02-05X00XX	< 0.68	32,000	< 0.34	6.0	81	0.67	< 0.14	< 340	21	< 1.8	83*	66,000	12	< 340	68	< 0.11	4.8	570	7.2*	< 0.34	< 340	< 0.68	1601*	17
SS-03-01X00XX	< 0.63	15,000	< 0.31	4.5	23	0.36	< 0.12	< 310	22	1.7	44	60,000	6.1	< 310	88	< 0.10	2.5	550	8.8*	< 0.31	< 310	< 0.63	130	19
SS-03-02X00XX	< 0.50	1,600	5.0*	1.5	60	< 0.20	< 0.10	< 250	0.88	< 1.3	7.2	14,000	50	< 250	8.2	< 0.084	< 2.0	< 250	3.8*	< 0.25	< 250	< 0.50	20	< 3.1
SS-03-03X00XX	< 0.56	16,000	< 0.28	5.1	140	0.30	< 0.11	< 280	11	< 1.5	43	58,000	15	< 280	33	< 0.093	2.6	340	6.8*	< 0.28	< 280	< 0.56	58	14
SS-05-01X00XX	< 0.54	J 1,400	J< 0.27	2.4	J 87	< 0.22	< 0.11	< 270	0.99	< 1.4	6.3	21,000	5.0	< 270	1.5	< 0.090	< 2.2	J 430	6.0*	< 0.27	< 270	J< 0.54	10	9.2
SS-05-02X00XX	< 0.61	J 14,000	J< 0.30	4.9	J 58	0.32	< 0.12	< 300	14	< 1.6	37	53,000	6.0	< 300	34	< 0.10	2.9	J 300	6.0*	< 0.30	< 300	J< 0.61	110	9.7
SS-05-03X00XD	< 0.52	J 450	J< 0.26	1.6	J 130	< 0.21	< 0.10	< 260	0.51	< 1.4	2.2	8,400	1.4	< 260	< 0.79	< 0.087	< 2.1	< 260	2.8	< 0.26	< 260	J< 0.52	3.7	< 2.6
SS-05-03X00XX	< 0.54	J 440	J< 0.27	1.4	J 120	< 0.22	< 0.11	< 270	0.48	< 1.4	2.0	9,800	1.2	< 270	< 0.81	< 0.090	< 2.2	< 270	2.5	< 0.27	< 270	J< 0.54	3.2	< 2.7
SS-05-04X00XX	< 0.52	J 980	J< 0.26	2.0	J 160	< 0.21	< 0.10	< 260	0.84	< 1.4	6.5	22,000	2.5	< 260	< 0.79	< 0.087	< 2.1	< 260	5.7*	< 0.26	< 260	J< 0.52	8.2	3.0
SS-05-05X00XX	< 0.52	J 1,000	J< 0.26	1.4	J 66	< 0.21	< 0.10	< 260	1.3	< 1.4	4.0	9,800	1.8	< 260	2.4	< 0.086	< 2.1	< 260	3.8*	< 0.26	< 260	J< 0.52	8.6	< 2.6
SS-07-01X00XX	< 0.52	J 740	J< 0.26	1.9	62	< 0.21	< 0.10	< 260	2.0	< 1.4	5.6	22,000	2.3	< 260	J 2.6	< 0.086	< 2.1	< 260	4.6*	< 0.26	< 260	4.5*	9.8	< 2.6
SS-07-02X00XX	< 0.53	J 10,000	J< 0.26	3.0	20	0.38	< 0.11	< 260	6.1	4.0	30	31,000	3.6	J 660	J 130	< 0.088	4.0	J 460	16.7*	< 0.26	< 260	7.1*	33	J 5.5
SS-07-03X00XX	< 0.52	2,700	< 0.26	3.9	110	0.25	< 0.10	280	4.5	1.5	15	48,000	8.6	< 260	42	< 0.086	2.4	< 260	4.8*	< 0.26	< 260	4.6*	36	< 2.6
SS-08-01X00XX	< 0.54	J 7,900	J< 0.27	3.2	38	0.47	< 0.11	290	4.8	< 1.4	27	35,000	2.9	< 270	J 53	< 0.089	3.6	< 270	6.2*	< 0.27	< 270	5.8*	35	< 2.7
SS-08-02X00XX	< 0.53	J 8,200	J< 0.26	3.8	58	0.31	< 0.10	< 260	3.9	< 1.4	26	52,000	2.7	< 260	J 36	< 0.088	2.5	< 260	8.9*	< 0.26	< 260	12.9*	36	< 2.6
SS-09-01X00XX	< 0.56	J 13,000	J 3.0	5.7	76	0.30	< 0.11	1820*	16	1.6	73	38,000	120	J 460	J 130	0.46	15*	J 460	4.5*	< 0.28	< 280	6.8*	36	J 660*
SS-09-02X00XD	< 0.66	J 29,000	J< 0.33	4.0	33	0.66	< 0.13	< 330	12	< 1.7	35	48,000	11	J 2,600*	J 88	< 0.11	5.6	J 510	5.0*	< 0.33	< 330	8.0*	71	J 16
SS-09-02X00XX	< 0.66	J 15,000	J 0.44	3.5	25	0.52	< 0.13	< 330	11	< 1.7	32	59,000	9.9	J 460	J 35	< 0.11	4.9	J 420	4.9*	< 0.33	< 330	9.1*	66	J 6.7
Maximum Detected Value (AOCs)	ND	41,000	5.0	6.0	160*	0.77	ND	1820*	34	29*	83*	66,000	120*	2,600*	530*	0.46	15*	570	19*	0.55	ND	12*	3200*	160*
Two Times Arithmetic Mean (Background)	ND	47,610	ND	9.3	89	0.9	ND	430*	54	6.9	80	73,981	17	599	348	ND	9.5	1,083	3.8	1.80	ND	9.1	150	31
Region IX Residential PRGs HQ=0.1	120	7,600	3.1	0.39c	540	15	3.7	nutrient	210c	140nc*	310	2,300	400	nutrient	180	2.3	160	nutrient	39	39	nutrient	0.52	7.8	2,300
Region IX Industrial PRGs HQ=0.1	1,200	10,000	41	1.6c	6,700	190	45	nutrient	450c	1300nc*	4,100	10,000	800	nutrient	1,900	31	2,000	nutrient	510	510	nutrient	6.7	100	10,000
Maximum Detected Background Value	ND	48,000	ND	17	150	1.0	ND	430	120	14	160	78,000	20	730	2,500	ND	11	1,100	5.1	1.30	ND	14	170	33
Piedmont Background Soil Concentrations[1]	1[2]	32,695	6[2]	18	68	0.6[2]	1[2]	928[2]	38	5[2]	16	32,412	15.1[2]	2,529	288	0.23[2]	10.4	2,843	1[2]	5[2]	256[2]	86	NE	39

Note:

results expressed in mg/kg (milligram per kilogram)

< less than (not detected)

J estimated value

AOCs Areas of Concern

* maximum value

2.9 **value exceeds Region IX PRG (See Table 7)**

91 value exceeds Two Times Arithmetic Mean (Background) (See Table 2)

120 **value exceeds both Region IX PRG and Two Times Arithmetic Mean (Background)**

ND not detected in background samples

nc* risk-based value associated with a HQ=0.1 is lower than the risk-based value associated with a 1E-06 cancer risk

nutrient element is considered a macronutrient

1 Table 2 Upper Confidence Limit *Piedmont Soils (Elements in South Carolina Inferred Background Soil and Stream Sediment Samples,* SC Geology, 1999, v41, p. 11-25)

2 Table 2 Upper Confidence Limit *State Wide Soils (Elements in South Carolina Inferred Background Soil and Stream Sediment Samples,* SC Geology, 1999, v41, p. 11-25)

1.92308

Created by: BC
Checked by: JPC

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MACTEC Engineering and Consulting ☐
MACTEC Development ☐

MEMORANDUM

DATE:	**February 12, 2007**
FROM:	Jay Peters
SUBJECT:	**Human Health Risk Screening - Soil Data – Henry's Knob Former Mine Site**
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incremental risk, which is the risk that is over and above the risk associated with the natural background conditions, is 0.5, which is below the threshold HI of 1. It is notable also that the maximum concentration of thallium in the Site-specific background soil data set (14 mg/kg) is higher than the maximum concentration detected in soil samples collected at the Site. Collectively, this suggests that risks associated with thallium in soil samples collected at the Site are not distinguishable from risks associated with soil samples collected at background locations.

Vanadium. Vanadium was detected at the majority of locations at concentrations above the residential soil PRG screening value of 7.8 mg/kg, ranging from 8.2 mg/kg to 200 mg/kg. If it was assumed that children and adults contacted soil at these locations almost every day during play and outdoor activities, the HI values for all but five of the locations would be below 1. However, the HI associated with the Site-specific background value of 150 mg/kg (a HI of 1.9) is also greater than 1. For all of the soil samples except SS-02-02 and SS-02-05, the risk associated with exposure to vanadium at the background locations is greater than the risk associated with exposure to vanadium in samples collected at the Site. For samples SS-02-02 and SS-02-05, the incremental risk, which is the risk that is over and above the risk associated with the natural background conditions, are HI values of 0.64 and 0.13, respectively, which are below the threshold HI of 1. It is notable also that the there is only one sample collected at the Site with a concentration greater than the maximum detected vanadium concentration in the Site-specific background soil data set (170 mg/kg). Collectively, this suggests that risks associated with vanadium in soil samples collected at the Site are not distinguishable from risks associated with soil samples collected at background locations.

JP

Attachments

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AOC Soil Analytical Results vs. Human Health Screening Values
Step 1 RI Implementation
October 2005
Henry's Knob Former Mine Site
York County, South Carolina

Sample ID	Cyanide-Total mg/kg	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Thallium mg/kg	Vanadium mg/kg	Zinc mg/kg
SS-01-01X00XX	< 0.59	4,500	< 0.29	2.9	71	< 0.23	< 0.12	< 290	7.8	5.3	76	48,000	6.5	< 290	22	< 0.097	< 2.3	< 290	9.0	< 0.29	< 290	< 0.59	37	< 7.7
SS-01-02X00XX	< 0.64	710	< 0.32	4.7	26	< 0.26	< 0.13	< 320	1.2	14	12	29,000	1.8	< 320	11	< 0.11	4.4	< 320	19	0.55	< 320	< 0.64	9.6	< 3.2
SS-01-03X00XX	< 0.52	880	< 0.26	5.4	67	< 0.21	< 0.10	< 260	3.6	< 1.4	7.2	27,000	2.3	< 260	< 0.78	< 0.086	< 2.1	< 260	10	< 0.26	< 260	< 0.52	22	< 2.6
SS-01-05X00XX	< 0.53	1,000	< 0.26	1.8	83	< 0.21	< 0.10	< 260	1.8	< 1.4	9.2	19,000	2.6	< 260	4.7	< 0.086	< 2.1	< 260	5.4	< 0.26	< 260	< 0.52	14	< 3.0
SS-01-06X00XX	< 0.74	12,000	< 0.37	5.0	130	0.34	< 0.15	< 370	10	< 1.9	38	52,000	17	< 370	40	< 0.12	< 3.0	< 370	19.7	< 0.37	< 370	< 0.74	10	< 2.7
SS-02-01X00XX	< 0.54	2,100	< 0.27	2.3	70	< 0.22	< 0.11	< 270	5.5	1.7	15	19,000	1.9	< 270	6.6	< 0.09	< 2.2	< 270	5.4	< 0.27	< 270	< 0.54	74	< 11.
SS-02-02X00XX	< 0.61	41,000	< 0.31	2.8	44	0.77	< 0.12	< 310	34	29	79	66,000	8.4	680	830	< 0.10	29.5	560	3.6	< 0.31	< 310	< 0.61	27	4.0
SS-02-03X00XX	< 0.55	7,100	< 0.28	2.7	39	0.22	< 0.11	< 280	9.5	3.3	23	35,000	3.3	< 280	43	< 0.092	< 2.2	< 280	6.0	< 0.28	< 280	< 0.55	200	31
SS-02-04X00XP	< 0.64	15,000	< 0.32	3.7	66	0.37	< 0.13	< 320	12	< 1.7	30	50,000	6.1	< 320	41	< 0.11	< 2.6	360	5.0	< 0.32	< 320	< 0.64	59	5.7
SS-02-04X00XX	< 0.64	17,000	< 0.32	4.0	61	0.42	< 0.13	< 320	13	< 1.6	34	46,000	6.9	< 320	49	< 0.10	2.6	410	5.5	< 0.32	< 320	< 0.64	89	7.8
SS-02-05X00XX	< 0.68	32,000	< 0.34	6.0	81	0.67	< 0.14	< 340	21	< 1.8	83	66,000	12	< 340	68	< 0.11	4.8	570	7.27	< 0.34	< 340	< 0.68	160	17
SS-03-01X00XX	< 0.63	15,000	< 0.31	4.5	23	0.36	< 0.12	< 310	22	1.7	44	60,000	6.1	< 310	88	< 0.10	2.5	550	6.8	< 0.31	< 310	< 0.63	130	19
SS-03-02X00XX	< 0.50	1,600	< 0.25	1.5	60	< 0.20	< 0.10	< 250	0.88	< 1.3	7.2	14,000	50	< 250	8.2	< 0.084	< 2.0	< 250	3.8	< 0.25	< 250	< 0.50	20	< 3.1
SS-03-03X00XX	< 0.56	16,000	< 0.28	5.1	140	0.30	< 0.11	< 280	11	< 1.5	43	58,000	15	< 280	33	< 0.093	2.6	340	6.8	< 0.28	< 280	< 0.56	58	14
SS-05-01X00XX	< 0.54	J 1,400	J< 0.27	2.4	J 87	< 0.22	< 0.11	< 270	0.99	< 1.4	6.3	21,000	5.0	< 270	1.5	< 0.090	< 2.2	J 430	6.0	< 0.27	< 270	J< 0.54	10	6.2
SS-05-03X00XX	< 0.61	J 14,000	J< 0.30	4.9	J 58	0.32	< 0.12	< 300	14	< 1.6	37	53,000	6.0	< 300	34	< 0.10	2.9	J 300	6.0	< 0.30	< 300	J< 0.61	110	9.7
SS-05-03X00XD	< 0.52	J 450	J< 0.26	1.6	J 130	< 0.21	< 0.10	< 260	0.51	< 1.4	2.2	8,400	1.4	< 260	< 0.79	< 0.087	< 2.1	< 260	2.8	< 0.26	< 260	J< 0.52	3.7	< 2.6
SS-05-04X00XX	< 0.54	J 440	J< 0.27	1.4	J 120	< 0.22	< 0.11	< 270	0.48	< 1.4	2.0	9,800	1.2	< 270	< 0.81	< 0.090	< 2.2	< 270	2.5	< 0.27	< 270	J< 0.54	3.2	< 2.7
SS-05-05X00XX	< 0.52	J 980	J< 0.26	2.0	J 160	< 0.21	< 0.10	< 260	0.84	< 1.4	6.5	22,000	2.5	< 260	< 0.79	< 0.087	< 2.1	< 260	5.1	< 0.26	< 260	J< 0.52	8.2	3.0
SS-07-01X00XX	< 0.52	J 740	J< 0.26	1.9	62	< 0.21	< 0.10	< 260	2.0	< 1.4	5.6	22,000	2.3	< 260	J 2.6	< 0.086	< 2.1	< 260	3.8	< 0.26	< 260	J< 0.52	8.6	< 2.6
SS-07-02X00XX	< 0.53	J 10,000	J< 0.26	3.0	20	0.36	< 0.11	< 260	6.1	4.0	30	31,000	3.6	J 660	J 130	< 0.088	4.0	J 480	4.6	< 0.26	< 260	4.5	9.8	< 2.6
SS-07-03X00XX	< 0.52	2,700	< 0.26	3.9	110	0.25	< 0.10	280	4.5	1.5	15	48,000	8.6	< 260	42	< 0.086	2.4	< 260	5.1	< 0.26	< 260	4.8	33	J 5.5
SS-08-01X00XX	< 0.54	J 7,900	J< 0.27	3.2	38	0.47	< 0.11	290	4.8	< 1.4	27	35,000	2.9	< 270	J 53	< 0.089	3.6	< 270	6.2	< 0.27	< 270	6.8	35	< 2.7
SS-08-02X00XX	< 0.53	J 8,200	J< 0.26	3.8	58	0.31	< 0.10	< 260	3.9	< 1.4	26	52,000	2.7	< 260	J 36	< 0.088	2.5	< 260	6.9	< 0.26	< 260	12	36	< 2.6
SS-09-01X00XX	< 0.56	J 13,000	J 3.0	5.7	76	0.30	< 0.11	820	16	1.6	73	35,000	120	J 460	J 130	0.48	15	J 480	4.5	< 0.28	< 280	6.8	36	160
SS-09-02X00XD	< 0.66	J 29,000	J< 0.33	4.0	33	0.66	< 0.13	< 330	12	< 1.7	35	48,000	11	2,600	J 88	< 0.11	5.6	J 510	5.0	< 0.33	< 330	8.0	71	J 16
SS-09-02X00XX	< 0.66	J 15,000	J 0.44	3.5	25	0.52	< 0.13	< 330	11	< 1.7	32	59,000	9.9	J 460	J 35	< 0.11	4.9	J 420	4.9	< 0.33	< 330	8.1	66	J 8.7
Maximum Detected Value (AOCs)	ND	41,000	5.0	6.0	460	0.77	ND	820	34	29	83	66,000	120	2,600	830	0.48	15	570	19.0	0.55	ND	12	200	160
Two Times Arithmetic Mean (Background)	ND	47,610	ND	9.3	89	0.9	ND	430*	54	6.9	80	73,981	17	599	348	ND	9.5	1,083	3.8	1.60	ND	9.1	150	31
Region IX Residental PRGs HQ=0.1	120	7,600	3.1	0.39c	540	15	3.7	nutrient	210c	140nc*	310	2,300	400	nutrient	180	2.3	160	nutrient	39	39	nutrient	0.52	7.8	2,300
Region IX Industrial PRGs HQ=0.1	1,200	10,000	41	1.6c	6,700	190	45	nutrient	450c	1300nc*	4,100	10,000	800	nutrient	1,900	31	2,000	nutrient	510	510	nutrient	6.7	100	10,000
Maximum Detected Background Value	ND	48,000	ND	17	150	1.0	ND	430	120	14	160	78,000	20	730	2,500	ND	11	1,100	5.1	1.30	ND	14	170	33
Piedmont Background Soil Concentrations[1]	1[2]	32,695	6[2]	18	68	0.6[2]	1[2]	928[2]	38	5[3]	16	32,412	15.1[2]	2,529	288	0.23[2]	10.4	2,843	1[2]	5[2]	256[2]	86	NE	39

Note:

results expressed in mg/kg (milligram per kilogram)
< less than (not detected)
J estimated value
AOCs Areas of Concern
* maximum value
2.9 **value exceeds Region IX PRG (See Table 7)**
91 **value exceeds Two Times Arithmetic Mean (Background) (See Table 2)**
120 **value exceeds both Region IX PRG and Two Times Arithmetic Mean (Background)**
ND not detected in background samples
nc* risk-based value associated with a HQ=0.1 is lower than the risk-based value associated with a 1E-06 cancer risk
nutrient element is considered a macronutrient
1 Table 2 Upper Confidence Limit *Piedmont Soils (Elements in South Carolina Inferred Background Soil and Stream Sediment Samples*, SC Geology, 1999, v41, p. 11-25)
2 Table 2 Upper Confidence Limit *State Wide Soils (Elements in South Carolina Inferred Background Soil and Stream Sediment Samples*, SC Geology, 1999, v41, p. 11-25)

1.92308

Created by: BC
Checked by: JPC

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MACTEC, Inc. ☐
MACTEC Engineering and Consulting ☐
MACTEC Development ☐

MEMORANDUM

DATE:	**February 12, 2007**
FROM:	Jay Peters
SUBJECT:	**Human Health Risk Screening - Soil Data – Henry's Knob Former Mine Site**
TO:	Elaine Hammick
COPY TO:	File

The soil data collected in support of the Remedial Investigation (RI) for the Henry's Knob Former Mine Site (Site) were compared to various screening values in the Step 1 RI Report (MACTEC, 2006) to help place perspective on the significance of the detected concentrations and to help guide future site investigation activities. This memorandum provides additional discussion concerning potential risks to human health.

Table 3A of the Step 1 RI Report presented a comparison of analytical results for soil samples collected throughout the Site to USEPA Region IX Preliminary Remediation Goals (PRGs) for residential use soil, USEPA Region IX PRGs for industrial use soil, Piedmont background soil concentrations, and site-specific background soil concentrations. Table 3A is attached to this memorandum for reference.

The USEPA Region IX PRG values are risk-based soil concentrations that are protective for exposures to analytes in soil at specified target risk levels. The residential soil PRGs are protective for young children and adults who are assumed to ingest and contact soil, and inhale soil-derived dust, during activities such as gardening and playing on the ground, 350 days per year over a 30-year period. The industrial soil PRGs are protective for adults who are assumed to ingest and contact soil, and inhale soil-derived dust, during work-day activities, 250 days per year over a 25-year period. The PRG values used for soil data comparisons in Table 3A are considered to be PRG screening values because they are based on target risks below the EPA threshold risk criteria. Specifically, they are set at an excess lifetime cancer risk (ELCR) of 1 in 1 million ($1x10^{-6}$), which represents the lower bound, or point-of-departure, of the USEPA cancer risk range, and a target hazard index (HI) of 0.1, which represents $1/10^{th}$ the maximum acceptable risk level for non-carcinogenic health effects.

Collectively, the residential soil PRG screening values and site-specific background values are used to select chemicals of potential concern (COPCs). COPCs are the chemicals that could pose more than a negligible risk and are therefore quantitatively evaluated in the risk assessment. According to USEPA Region IV risk assessment guidance, chemicals are selected as COPCs if their maximum detected concentrations are greater than both the USEPA Region IX residential soil PRG screening value and the site-specific background value.

A review of the information presented in Table 3A indicates that seven inorganic analytes were detected at concentrations greater than the residential PRG screening values: aluminum, antimony, arsenic, iron, manganese, thallium, and vanadium. Of these analytes, aluminum, arsenic, and iron were detected at concentrations below the site-specific background values in all of the samples. Based on the soil data collected to date and presented in Table 3A, these three analytes would not be selected as COPCs in a risk assessment. Manganese and thallium were each detected in one sample at a concentration greater than the site-specific background value, and vanadium was detected in two samples at concentrations greater than the site-specific background values. Antimony was not detected in the Site-specific background data set, but the maximum detected concentration in samples collected from the Site is less than the background value for Piedmont soils. These analytes are further discussed in the context screening-level health risks.

Antimony. Antimony was detected at location SS-03-02 at a concentration (5 mg/kg) slightly above the residential soil PRG screening value of 3.1 mg//kg. If it was assumed that children and adults contacted soil at this location almost every day during play and outdoor activities, the HI would be only 0.17, which is well below the USEPA threshold HI of 1. This indicates that antimony at this location does not pose a health risk in excess of USEPA risk limits.

Manganese. Manganese was detected at location SS-02-02 at a concentration (830 mg/kg) above the residential soil PRG screening value of 180 mg/kg. If it was assumed that children and adults contacted soil at this location almost every day during play and outdoor activities, the HI would be only 0.46, which is well below the USEPA threshold HI of 1. This indicates that manganese at this location does not pose a health risk in excess of USEPA risk limits.

Thallium. Thallium was detected at locations SS-07-01-03, SS-08-01-02, and SS-09-01-02 at concentrations ranging from 4.5 mg/kg to 12 mg/kg, which are above the residential soil PRG screening value of 0.52 mg/kg. If it was assumed that children and adults contacted soil at each of these locations almost every day during play and outdoor activities, the HI values would range from 0.86 to 2.3. However, the HI associated with the Site-specific background value of 9.1 mg/kg (a HI of 1.8) is also greater than 1. For all of the soil samples except SS-08-01, the risk associated with exposure to thallium at the background locations is greater than the risk associated with exposure to thallium in samples collected at the Site. For sample SS-08-01, the

incremental risk, which is the risk that is over and above the risk associated with the natural background conditions, is 0.5, which is below the threshold HI of 1. It is notable also that the maximum concentration of thallium in the Site-specific background soil data set (14 mg/kg) is higher than the maximum concentration detected in soil samples collected at the Site. Collectively, this suggests that risks associated with thallium in soil samples collected at the Site are not distinguishable from risks associated with soil samples collected at background locations.

Vanadium. Vanadium was detected at the majority of locations at concentrations above the residential soil PRG screening value of 7.8 mg/kg, ranging from 8.2 mg/kg to 200 mg/kg. If it was assumed that children and adults contacted soil at these locations almost every day during play and outdoor activities, the HI values for all but five of the locations would be below 1. However, the HI associated with the Site-specific background value of 150 mg/kg (a HI of 1.9) is also greater than 1. For all of the soil samples except SS-02-02 and SS-02-05, the risk associated with exposure to vanadium at the background locations is greater than the risk associated with exposure to vanadium in samples collected at the Site. For samples SS-02-02 and SS-02-05, the incremental risk, which is the risk that is over and above the risk associated with the natural background conditions, are HI values of 0.64 and 0.13, respectively, which are below the threshold HI of 1. It is notable also that the there is only one sample collected at the Site with a concentration greater than the maximum detected vanadium concentration in the Site-specific background soil data set (170 mg/kg). Collectively, this suggests that risks associated with vanadium in soil samples collected at the Site are not distinguishable from risks associated with soil samples collected at background locations.

JP

Attachments

Table 3A
AOC Soil Analytical Results vs. Human Health Screening Values
Step 1 RI Implementation
October 2005
Henry's Knob Former Mine Site
York County, South Carolina

Sample ID	Cyanide-Total mg/kg	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Thallium mg/kg	Vanadium mg/kg	Zinc mg/kg
SS-01-01X00XX	< 0.59	4,500	< 0.29	**2.9**	71	< 0.23	< 0.12	< 290	7.8	5.3	76	**48,000**	6.5	< 290	22	< 0.097	< 2.3	< 290	[illegible]	< 0.29	< 290	< 0.59	**37**	< 7.7
SS-01-02X00XX	< 0.64	710	< 0.32	**4.7**	26	< 0.26	< 0.13	< 320	1.2	[illegible]	12	**29,000**	1.8	< 320	11	< 0.11	4.4	< 320	[illegible]	0.55	< 320	< 0.64	**9.6**	< 3.2
SS-01-03X00XX	< 0.52	880	< 0.26	**5.4**	67	< 0.21	< 0.10	< 260	3.6	< 1.4	7.2	**27,000**	2.3	< 260	< 0.78	< 0.086	< 2.1	< 260	[illegible]	< 0.26	< 260	< 0.52	**22**	< 2.6
SS-01-04X00XX	< 0.52	880	< 0.26	**1.9**	83	< 0.21	< 0.10	< 260	1.8	< 1.4	9.2	**19,000**	2.6	< 260	4.7	< 0.086	< 2.1	< 260	[illegible]	< 0.26	< 260	< 0.52	**14**	< 3.0
SS-01-05X00XX	< 0.53	1,000	< 0.26	**1.6**	[illegible] 91	< 0.21	< 0.10	< 260	2.0	< 1.4	5.6	**15,000**	2.2	< 260	6.4	< 0.087	< 2.1	< 260	[illegible]	< 0.26	< 260	< 0.53	**10**	< 2.7
SS-01-06X00XX	< 0.74	**12,000**	< 0.37	**5.0**	[illegible] 130	0.34	< 0.15	< 370	10	< 1.9	**38**	**52,000**	[illegible]	< 370	40	< 0.12	< 3.0	< 370	[illegible]	< 0.37	< 370	< 0.74	**74**	< 11
SS-02-01X00XX	< 0.54	2,100	< 0.27	**2.3**	70	< 0.22	< 0.11	< 270	5.5	1.7	15	**19,000**	1.9	< 270	6.6	< 0.09	< 2.2	< 270	[illegible]	< 0.27	< 270	< 0.54	**27**	4.0
SS-02-02X00XX	< 0.61	**41,000**	< 0.31	**2.8**	44	0.77	< 0.12	< 310	34	[illegible] 29	79	**66,000**	8.4	[illegible] 680	[illegible] 830	< 0.10	[illegible] 9.5	560	3.6	< 0.31	< 310	< 0.61	**200**	[illegible] 31
SS-02-03X00XX	< 0.55	7,100	< 0.28	**2.7**	39	0.22	< 0.11	< 280	9.5	3.3	23	**35,000**	3.3	< 280	43	< 0.092	< 2.2	< 280	[illegible] 6.0	< 0.28	< 280	< 0.55	**59**	5.7
SS-02-04X00XP	< 0.64	**15,000**	< 0.32	**3.7**	66	0.37	< 0.13	< 320	12	< 1.7	30	**50,000**	6.1	< 320	41	< 0.11	< 2.6	360	5.0	< 0.32	< 320	< 0.64	**89**	7.8
SS-02-04X00XX	< 0.64	**17,000**	< 0.32	**4.0**	61	0.42	< 0.13	< 320	13	< 1.6	34	**46,000**	6.9	< 320	49	< 0.10	2.6	410	5.5	< 0.32	< 320	< 0.64	**110**	9.3
SS-02-05X00XX	< 0.68	**32,000**	< 0.34	**6.0**	81	0.67	< 0.14	< 340	21	< 1.8	**83**	**66,000**	12	< 340	68	< 0.11	4.8	570	[illegible] 7.2	< 0.34	< 340	< 0.68	[illegible] **160**	17
SS-03-01X00XX	< 0.63	**15,000**	< 0.31	**4.5**	23	0.38	< 0.12	< 310	22	1.7	**44**	**60,000**	6.1	< 310	88	< 0.10	2.5	550	[illegible] 6.8	< 0.31	< 310	< 0.63	**130**	19
SS-03-02X00XX	< 0.50	1,600	[illegible] **5.0**	**1.5**	60	< 0.20	< 0.10	< 250	0.88	< 1.3	7.2	**14,000**	50	< 250	8.2	< 0.084	< 2.0	< 250	[illegible] 3.8	< 0.25	< 250	< 0.50	**20**	< 3.1
SS-03-03X00XX	< 0.56	**15,000**	< 0.28	**5.1**	[illegible] 140	0.30	< 0.11	< 280	11	< 1.5	**43**	**58,000**	15	< 280	33	< 0.093	2.8	340	[illegible] 6.8	< 0.28	< 280	< 0.56	**58**	14
SS-05-01X00XX	< 0.54	J 1,400	J< 0.27	**2.4**	J 87	< 0.22	< 0.11	< 270	0.99	< 1.4	6.3	**21,000**	5.0	< 270	1.5	< 0.090	< 2.2	J 430	[illegible] 6.0	< 0.27	< 270	J< 0.54	**10**	6.2
SS-05-02X00XX	< 0.61	J **14,000**	J< 0.30	**4.9**	J 58	0.32	< 0.12	< 320	14	< 1.6	37	**53,000**	6.0	< 300	34	< 0.10	2.9	J 300	[illegible] 6.0	< 0.30	< 300	J< 0.61	**110**	9.7
SS-05-03X00XD	< 0.52	J 450	J< 0.26	**1.6**	[illegible] 130	< 0.21	< 0.10	< 260	0.51	< 1.4	2.2	**8,400**	1.4	< 260	< 0.79	< 0.087	< 2.1	< 260	2.8	< 0.26	< 260	J< 0.52	**3.7**	< 2.6
SS-05-03X00XX	< 0.54	J 440	J< 0.27	**1.4**	[illegible] 120	< 0.22	< 0.11	< 270	0.48	< 1.4	2.0	**9,800**	1.2	< 270	< 0.81	< 0.090	< 2.2	< 270	2.5	< 0.27	< 270	J< 0.54	**3.2**	< 2.7
SS-05-04X00XX	< 0.52	J 980	J< 0.26	**2.0**	[illegible] 160	< 0.21	< 0.10	< 260	0.84	< 1.4	6.5	**22,000**	2.5	< 260	< 0.79	< 0.087	< 2.1	< 260	[illegible] 5.1	< 0.26	< 260	J< 0.52	**8.2**	3.0
SS-05-05X00XX	< 0.52	J 1,000	J< 0.26	**1.4**	J 66	< 0.21	< 0.10	< 260	1.3	< 1.4	4.0	**9,800**	1.8	< 260	2.4	< 0.086	< 2.1	< 260	[illegible] 3.8	< 0.26	< 260	J< 0.52	**8.6**	< 2.6
SS-07-01X00XX	< 0.52	J 740	J< 0.26	**1.9**	62	< 0.21	< 0.10	< 260	2.0	< 1.4	5.6	**22,000**	2.3	< 260	J 2.6	< 0.086	< 2.1	< 260	[illegible] 4.6	< 0.26	< 260	[illegible] 4.6	**9.8**	< 2.6
SS-07-02X00XX	< 0.53	J **10,000**	J< 0.28	**3.0**	20	0.36	< 0.11	< 280	6.1	4.0	30	**31,000**	3.6	J 660	J 130	< 0.088	4.0	J 480	[illegible] 6.7	< 0.26	< 260	[illegible] 17.1	**33**	J 5.5
SS-07-03X00XX	< 0.52	2,700	< 0.26	**3.9**	[illegible] 110	0.25	< 0.10	280	4.5	1.5	15	**48,000**	8.6	< 260	42	< 0.086	2.4	< 260	[illegible] 2.9	< 0.26	< 260	**4.8**	**38**	< 2.6
SS-08-01X00XX	< 0.54	J **7,900**	J< 0.27	**3.2**	38	0.47	< 0.11	290	4.8	< 1.4	27	**35,000**	2.9	< 270	J 53	< 0.089	3.6	< 270	[illegible] 6.2	< 0.27	< 270	**9.8**	**35**	< 2.7
SS-08-02X00XX	< 0.53	J **8,200**	J< 0.26	**3.8**	58	0.31	< 0.10	< 260	3.9	< 1.4	26	**52,000**	2.7	< 260	J 36	< 0.088	2.5	< 260	[illegible] 8.9	< 0.26	< 260	[illegible] 12.2	**36**	< 2.6
SS-09-01X00XX	< 0.56	J **13,000**	J 3.0	**5.7**	76	0.30	< 0.11	[illegible] 820	16	1.5	73	**35,000**	120	J 460	J 130	0.46	[illegible] 15	J 480	[illegible] 4.5	< 0.28	< 280	[illegible] 16.8	**36**	[illegible] 160
SS-09-02X00XD	< 0.66	J **29,000**	J< 0.33	**4.0**	33	0.66	< 0.13	< 330	12	< 1.7	35	**48,000**	11	[illegible] 2,600	J 88	< 0.11	5.6	J 510	[illegible] 5.0	< 0.33	< 330	[illegible] 18.0	**71**	J 16
SS-09-02X00XX	< 0.66	J **15,000**	J 0.44	**3.6**	25	0.52	< 0.13	< 330	11	< 1.7	32	**59,000**	9.9	J 460	J 35	< 0.11	4.9	J 420	[illegible] 4.9	< 0.33	< 330	[illegible] 9.12	**66**	J 6.7
Maximum Detected Value (AOCs)	ND	**41,000**	**5.0**	**6.0**	[illegible] 160	0.77	ND	[illegible] 820	34	[illegible] 29	[illegible] 83	**66,000**	[illegible] 120	2,600	**830**	0.46	[illegible] 15	570	[illegible] 19	0.55	ND	[illegible] 126	**200**	[illegible] 160
Two Times Arithmetic Mean (Background)	ND	47,610	ND	9.3	89	0.9	ND	430*	54	6.9	80	73,981	17	599	348	ND	9.5	1,083	3.8	1.60	ND	9.1	150	31
Region IX Residential PRGs HQ=0.1	120	7,800	3.1	0.39c	540	15	3.7	nutrient	210c	140nc*	310	2,300	400	nutrient	180	2.3	160	nutrient	39	39	nutrient	0.52	7.8	2,300
Region IX Industrial PRGs HQ=0.1	1,200	10,000	41	1.6c	6,700	190	45	nutrient	450c	1300nc*	4,100	10,000	800	nutrient	1,900	31	2,000	nutrient	510	510	nutrient	6.7	100	10,000
Maximum Detected Background Value	ND	48,000	ND	17	150	1.0	ND	430	120	14	160	78,000	20	730	2,500	ND	11	1,100	5.1	1.30	ND	14	170	33
Piedmont Background Soil Concentrations[1]	1[2]	32,695	6[2]	18	68	0.6[2]	1[2]	928[2]	38	5[2]	16	32,412	15.1[2]	2,529	288	0.23[2]	10.4	2,843	1[2]	5[2]	256[2]	86	NE	39

Note:

results expressed in mg/kg (milligram per kilogram)
< less than (not detected)
J estimated value
AOCs Areas of Concern
* maximum value
2.9 value exceeds Region IX PRG (See Table 7)
91 value exceeds Two Times Arithmetic Mean (Background) (See Table 2)
120 value exceeds both Region IX PRG and Two Times Arithmetic Mean (Background)
ND not detected in background samples
nc* risk-based value associated with a HQ=0.1 is lower than the risk-based value associated with a 1E-06 cancer risk
nutrient element is considered a macronutrient
1 Table 2 Upper Confidence Limit *Piedmont Soils (Elements in South Carolina Inferred Background Soil and Stream Sediment Samples.* SC Geology, 1999, v41, p. 11-25)
2 Table 2 Upper Confidence Limit *State Wide Soils (Elements in South Carolina Inferred Background Soil and Stream Sediment Samples.* SC Geology, 1999, v41, p. 11-25)

1.92308

MACTEC

MACTEC, Inc. ☐
MACTEC Engineering and Consulting ☐
MACTEC Development ☐

MEMORANDUM

DATE:	**February 12, 2007**
FROM:	Jay Peters
SUBJECT:	**Human Health Risk Screening - Soil Data – Henry's Knob Former Mine Site**
TO:	Elaine Hammick
COPY TO:	File

The soil data collected in support of the Remedial Investigation (RI) for the Henry's Knob Former Mine Site (Site) were compared to various screening values in the Step 1 RI Report (MACTEC, 2006) to help place perspective on the significance of the detected concentrations and to help guide future site investigation activities. This memorandum provides additional discussion concerning potential risks to human health.

Table 3A of the Step 1 RI Report presented a comparison of analytical results for soil samples collected throughout the Site to USEPA Region IX Preliminary Remediation Goals (PRGs) for residential use soil, USEPA Region IX PRGs for industrial use soil, Piedmont background soil concentrations, and site-specific background soil concentrations. Table 3A is attached to this memorandum for reference.

The USEPA Region IX PRG values are risk-based soil concentrations that are protective for exposures to analytes in soil at specified target risk levels. The residential soil PRGs are protective for young children and adults who are assumed to ingest and contact soil, and inhale soil-derived dust, during activities such as gardening and playing on the ground, 350 days per year over a 30-year period. The industrial soil PRGs are protective for adults who are assumed to ingest and contact soil, and inhale soil-derived dust, during work-day activities, 250 days per year over a 25-year period. The PRG values used for soil data comparisons in Table 3A are considered to be PRG screening values because they are based on target risks below the EPA threshold risk criteria. Specifically, they are set at an excess lifetime cancer risk (ELCR) of 1 in 1 million ($1x10^{-6}$), which represents the lower bound, or point-of-departure, of the USEPA cancer risk range, and a target hazard index (HI) of 0.1, which represents $1/10^{th}$ the maximum acceptable risk level for non-carcinogenic health effects.

Collectively, the residential soil PRG screening values and site-specific background values are used to select chemicals of potential concern (COPCs). COPCs are the chemicals that could pose more than a negligible risk and are therefore quantitatively evaluated in the risk assessment. According to USEPA Region IV risk assessment guidance, chemicals are selected as COPCs if their maximum detected concentrations are greater than both the USEPA Region IX residential soil PRG screening value and the site-specific background value.

A review of the information presented in Table 3A indicates that seven inorganic analytes were detected at concentrations greater than the residential PRG screening values: aluminum, antimony, arsenic, iron, manganese, thallium, and vanadium. Of these analytes, aluminum, arsenic, and iron were detected at concentrations below the site-specific background values in all of the samples. Based on the soil data collected to date and presented in Table 3A, these three analytes would not be selected as COPCs in a risk assessment. Manganese and thallium were each detected in one sample at a concentration greater than the site-specific background value, and vanadium was detected in two samples at concentrations greater than the site-specific background values. Antimony was not detected in the Site-specific background data set, but the maximum detected concentration in samples collected from the Site is less than the background value for Piedmont soils. These analytes are further discussed in the context screening-level health risks.

Antimony. Antimony was detected at location SS-03-02 at a concentration (5 mg/kg) slightly above the residential soil PRG screening value of 3.1 mg//kg. If it was assumed that children and adults contacted soil at this location almost every day during play and outdoor activities, the HI would be only 0.17, which is well below the USEPA threshold HI of 1. This indicates that antimony at this location does not pose a health risk in excess of USEPA risk limits.

Manganese. Manganese was detected at location SS-02-02 at a concentration (830 mg/kg) above the residential soil PRG screening value of 180 mg/kg. If it was assumed that children and adults contacted soil at this location almost every day during play and outdoor activities, the HI would be only 0.46, which is well below the USEPA threshold HI of 1. This indicates that manganese at this location does not pose a health risk in excess of USEPA risk limits.

Thallium. Thallium was detected at locations SS-07-01-03, SS-08-01-02, and SS-09-01-02 at concentrations ranging from 4.5 mg/kg to 12 mg/kg, which are above the residential soil PRG screening value of 0.52 mg/kg. If it was assumed that children and adults contacted soil at each of these locations almost every day during play and outdoor activities, the HI values would range from 0.86 to 2.3. However, the HI associated with the Site-specific background value of 9.1 mg/kg (a HI of 1.8) is also greater than 1. For all of the soil samples except SS-08-01, the risk associated with exposure to thallium at the background locations is greater than the risk associated with exposure to thallium in samples collected at the Site. For sample SS-08-01, the

incremental risk, which is the risk that is over and above the risk associated with the natural background conditions, is 0.5, which is below the threshold HI of 1. It is notable also that the maximum concentration of thallium in the Site-specific background soil data set (14 mg/kg) is higher than the maximum concentration detected in soil samples collected at the Site. Collectively, this suggests that risks associated with thallium in soil samples collected at the Site are not distinguishable from risks associated with soil samples collected at background locations.

Vanadium. Vanadium was detected at the majority of locations at concentrations above the residential soil PRG screening value of 7.8 mg/kg, ranging from 8.2 mg/kg to 200 mg/kg. If it was assumed that children and adults contacted soil at these locations almost every day during play and outdoor activities, the HI values for all but five of the locations would be below 1. However, the HI associated with the Site-specific background value of 150 mg/kg (a HI of 1.9) is also greater than 1. For all of the soil samples except SS-02-02 and SS-02-05, the risk associated with exposure to vanadium at the background locations is greater than the risk associated with exposure to vanadium in samples collected at the Site. For samples SS-02-02 and SS-02-05, the incremental risk, which is the risk that is over and above the risk associated with the natural background conditions, are HI values of 0.64 and 0.13, respectively, which are below the threshold HI of 1. It is notable also that the there is only one sample collected at the Site with a concentration greater than the maximum detected vanadium concentration in the Site-specific background soil data set (170 mg/kg). Collectively, this suggests that risks associated with vanadium in soil samples collected at the Site are not distinguishable from risks associated with soil samples collected at background locations.

JP

Attachments

Table 3A
AOC Soil Analytical Results vs. Human Health Screening Values
Step 1 RI Implementation
October 2005
Henry's Knob Former Mine Site
York County, South Carolina

Sample ID	Cyanide-Total mg/kg	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Thallium mg/kg	Vanadium mg/kg	Zinc mg/kg
SS-01-01X00XX	< 0.59	4,500	< 0.29	**2.9**	71	< 0.23	< 0.12	< 290	7.8	5.3	76	**48,000**	6.5	< 290	22	< 0.097	< 2.3	< 290	< 0.59	< 0.29	< 290	< 0.59	**37**	< 7.7
SS-01-02X00XX	< 0.64	710	< 0.32	**4.7**	26	< 0.26	< 0.13	< 320	1.2	[illegible]	12	**29,000**	1.8	< 320	11	< 0.11	4.4	< 320	[illegible]	0.55	< 320	< 0.64	**9.6**	< 3.2
SS-01-03X00XX	< 0.52	880	< 0.26	**5.4**	67	< 0.21	< 0.10	< 260	3.6	< 1.4	7.2	**27,000**	2.3	< 260	< 0.78	< 0.086	< 2.1	< 260	[illegible]	< 0.26	< 260	< 0.52	**22**	< 2.6
SS-01-04X00XX	< 0.52	880	< 0.26	**1.9**	83	< 0.21	< 0.10	< 260	1.8	< 1.4	9.2	**19,000**	2.6	< 260	4.7	< 0.086	< 2.1	< 260	[illegible]	< 0.26	< 260	< 0.52	**14**	< 3.0
SS-01-05X00XX	< 0.53	1,000	< 0.26	**1.6**	91	< 0.21	< 0.10	< 260	2.0	< 1.4	5.6	**15,000**	2.2	< 260	6.4	< 0.087	< 2.1	< 260	[illegible]	< 0.26	< 260	< 0.53	**10**	< 2.7
SS-01-06X00XX	< 0.74	**12,000**	< 0.37	**5.0**	130	0.34	< 0.15	< 370	10	< 1.9	38	**52,000**	[illegible]	< 370	40	< 0.12	< 3.0	< 370	[illegible]	< 0.37	< 370	< 0.74	**74**	< 11
SS-02-01X00XX	< 0.54	2,100	< 0.27	**2.3**	70	< 0.22	< 0.11	< 270	5.5	1.7	15	**19,000**	1.9	< 270	6.6	< 0.09	< 2.2	< 270	[illegible]	< 0.27	< 270	< 0.54	**27**	4.0
SS-02-02X00XX	< 0.61	**41,000**	< 0.31	**2.8**	44	0.77	< 0.12	< 310	34	[illegible]	79	**66,000**	8.4	680	**830**	< 0.10	[illegible]	560	3.6	< 0.31	< 310	< 0.61	**200**	131
SS-02-03X00XX	< 0.55	7,100	< 0.28	**2.7**	39	0.22	< 0.11	< 280	9.5	3.3	23	**35,000**	3.3	< 280	43	< 0.092	< 2.2	< 280	[illegible]	< 0.28	< 280	< 0.55	**59**	5.7
SS-02-04X00XP	< 0.64	**15,000**	< 0.32	**3.7**	66	0.37	< 0.13	< 320	12	< 1.7	30	**50,000**	6.1	< 320	41	< 0.11	< 2.6	360	[illegible]	< 0.32	< 320	< 0.64	**89**	7.8
SS-02-04X00XX	< 0.64	**17,000**	< 0.32	**4.0**	61	0.42	< 0.13	< 320	13	< 1.6	34	**46,000**	6.9	< 320	49	< 0.10	2.6	410	[illegible]	< 0.32	< 320	< 0.64	**110**	9.3
SS-02-05X00XX	< 0.68	**32,000**	< 0.34	**6.0**	81	0.67	< 0.14	< 340	21	< 1.8	[illegible]	**66,000**	12	< 340	68	< 0.11	4.8	570	[illegible]	< 0.34	< 340	< 0.68	**160**	17
SS-03-01X00XX	< 0.63	**15,000**	< 0.31	**4.5**	23	0.36	< 0.12	< 310	22	1.7	44	**60,000**	6.1	< 310	88	< 0.10	2.5	550	[illegible]	< 0.31	< 310	< 0.63	**130**	19
SS-03-02X00XX	< 0.50	1,800	[illegible]	**1.8**	60	< 0.20	< 0.10	< 250	0.88	< 1.3	7.2	**14,000**	50	< 250	8.2	< 0.084	< 2.0	< 250	[illegible]	< 0.25	< 250	< 0.50	**20**	< 3.1
SS-03-03X00XX	< 0.56	**16,000**	< 0.28	**5.1**	[illegible]	0.30	< 0.11	< 280	11	< 1.5	43	**58,000**	15	< 280	33	< 0.093	2.6	340	[illegible]	< 0.28	< 280	< 0.56	**58**	14
SS-05-01X00XX	< 0.54	J 1,400	J< 0.27	**2.4**	J 87	< 0.22	< 0.11	< 270	0.99	< 1.4	6.3	**21,000**	5.0	< 270	1.5	< 0.090	< 2.2	J 430	[illegible]	< 0.27	< 270	J< 0.54	**10**	6.2
SS-05-02X00XX	< 0.61	J **14,000**	J< 0.30	**4.9**	J 58	0.32	< 0.12	< 300	14	< 1.6	37	**53,000**	6.0	< 300	34	< 0.10	2.9	J 300	[illegible]	< 0.30	< 300	J< 0.61	**110**	9.7
SS-05-03X00XD	< 0.52	J 450	J< 0.26	**1.6**	J 130	< 0.21	< 0.10	< 260	0.51	< 1.4	2.2	**8,400**	1.4	< 260	< 0.79	< 0.087	< 2.1	< 260	2.8	< 0.26	< 260	J< 0.52	**3.7**	< 2.6
SS-05-03X00XX	< 0.54	J 440	J< 0.27	**1.4**	J 120	< 0.22	< 0.11	< 270	0.48	< 1.4	2.0	**9,800**	1.2	< 270	< 0.81	< 0.090	< 2.2	< 270	2.5	< 0.27	< 270	J< 0.54	**3.2**	< 2.7
SS-05-04X00XX	< 0.52	J 980	J< 0.26	**2.0**	160	< 0.21	< 0.10	< 260	0.84	< 1.4	6.5	**22,000**	2.5	< 260	< 0.79	< 0.087	< 2.1	< 260	[illegible]	< 0.26	< 260	J< 0.52	**8.2**	3.0
SS-05-05X00XX	< 0.52	J 1,000	J< 0.26	**1.4**	J 66	< 0.21	< 0.10	< 260	1.3	< 1.4	4.0	**9,800**	1.8	< 260	2.4	< 0.086	< 2.1	< 260	[illegible]	< 0.26	< 260	J< 0.52	**8.6**	< 2.6
SS-07-01X00XX	< 0.52	J 740	J< 0.26	**1.9**	62	< 0.21	< 0.10	< 260	2.0	< 1.4	5.6	**22,000**	2.3	< 260	J 2.6	< 0.086	< 2.1	< 260	[illegible]	< 0.26	< 260	**4.5**	**9.8**	< 2.6
SS-07-02X00XX	< 0.53	J **10,000**	J< 0.26	**3.0**	20	0.56	< 0.11	< 260	6.1	4.0	30	**31,000**	3.6	J 660	J 130	< 0.088	4.0	J 480	[illegible]	< 0.26	< 260	[illegible]	**33**	J 5.5
SS-07-03X00XX	< 0.52	2,700	< 0.26	**3.9**	110	0.25	< 0.10	280	4.5	1.5	15	**48,000**	8.6	< 260	42	< 0.086	2.4	< 260	[illegible]	< 0.26	< 260	**14.8**	**36**	< 2.6
SS-08-01X00XX	< 0.54	J **7,900**	J< 0.27	**3.2**	38	0.47	< 0.11	290	4.8	< 1.4	27	**35,000**	2.9	< 270	J 53	< 0.089	3.6	< 270	[illegible]	< 0.27	< 270	[illegible]	**35**	< 2.7
SS-08-02X00XX	< 0.53	J **8,200**	J< 0.26	**3.8**	58	0.31	< 0.10	< 260	3.9	< 1.4	26	**52,000**	2.7	< 260	J 36	< 0.088	2.5	< 260	[illegible]	< 0.26	< 260	[illegible]	**35**	< 2.6
SS-09-01X00XX	< 0.56	J **13,000**	J 3.0	**5.7**	76	0.30	< 0.11	[illegible]	16	1.6	73	**35,000**	120	J 460	J 130	0.46	[illegible]	J 480	[illegible]	< 0.28	< 280	[illegible]	**35**	[illegible]
SS-09-02X00XD	< 0.66	J **29,000**	J< 0.33	**4.0**	33	0.66	< 0.13	< 330	12	< 1.7	35	**48,000**	11	J 2,600	J 88	< 0.11	5.6	J 510	[illegible]	< 0.33	< 330	**8.0**	**71**	J 16
SS-09-02X00XX	< 0.66	J **15,000**	J 0.44	**3.6**	25	0.52	< 0.13	< 330	11	< 1.7	32	**59,000**	9.9	J 460	J 35	< 0.11	4.9	J 420	[illegible]	< 0.33	< 330	**9.1**	**66**	J 6.7
Maximum Detected Value (AOCs)	ND	**41,000**	**5.0**	**6.0**	160	0.77	ND	820	34	29	83	**66,000**	120	2,600	**830**	0.46	15	570	19	0.55	ND	**12**	**200**	160
Two Times Arithmetic Mean (Background)	ND	47,610	ND	9.3	89	0.9	ND	430*	54	6.9	80	73,981	17	599	348	ND	9.5	1,083	3.8	1.60	ND	9.1	150	31
Region IX Residential PRGs HQ=0.1	120	7,600	3.1	0.39c	540	15	3.7	nutrient	210c	140nc*	310	2,300	400	nutrient	180	2.3	160	nutrient	39	39	nutrient	0.52	7.8	2,300
Region IX Industrial PRGs HQ=0.1	1,200	10,000	41	1.6c	6,700	190	45	nutrient	450c	1300nc*	4,100	10,000	800	nutrient	1,900	31	2,000	nutrient	510	510	nutrient	67	100	10,000
Maximum Detected Background Value	ND	48,000	ND	17	150	1.0	ND	430	120	14	160	78,000	20	730	2,500	ND	11	1,100	5.1	1.30	ND	14	170	33
Piedmont Background Soil Concentrations[1]	1[2]	32,695	6[2]	18	68	0.6[2]	1[2]	928[2]	38	5[2]	16	32,412	15.1[2]	2,529	288	0.23[2]	10.4	2,843	1[2]	5[2]	256[2]	86	NE	39

Note

results expressed in mg/kg (milligram per kilogram)
< less than (not detected)
J estimated value
AOCs Areas of Concern
* maximum value
2.9 **value exceeds Region IX PRG (See Table 7)**
91 **value exceeds Two-Times Arithmetic Mean (Background) (See Table 2)**
120 **value exceeds both Region IX PRG and Two-Times Arithmetic Mean (Background)**
ND not detected in background samples
nc* risk-based value associated with a HQ=0.1 is lower than the risk-based value associated with a 1E-06 cancer risk
nutrient element is considered a macronutrient
1 Table 2 Upper Confidence Limit *Piedmont Soils (Elements in South Carolina Inferred Background Soil and Stream Sediment Samples*, SC Geology, 1999, v41, p. 11-25)
2 Table 2 Upper Confidence Limit *State Wide Soils (Elements in South Carolina Inferred Background Soil and Stream Sediment Samples*, SC Geology, 1999, v41, p. 11-25)

1.92308

MACTEC

MACTEC, Inc. ☐
MACTEC Engineering and Consulting ☐
MACTEC Development ☐

MEMORANDUM

DATE:	**February 12, 2007**
FROM:	Jay Peters
SUBJECT:	**Human Health Risk Screening - Soil Data – Henry's Knob Former Mine Site**
TO:	Elaine Hammick
COPY TO:	File

The soil data collected in support of the Remedial Investigation (RI) for the Henry's Knob Former Mine Site (Site) were compared to various screening values in the Step 1 RI Report (MACTEC, 2006) to help place perspective on the significance of the detected concentrations and to help guide future site investigation activities. This memorandum provides additional discussion concerning potential risks to human health.

Table 3A of the Step 1 RI Report presented a comparison of analytical results for soil samples collected throughout the Site to USEPA Region IX Preliminary Remediation Goals (PRGs) for residential use soil, USEPA Region IX PRGs for industrial use soil, Piedmont background soil concentrations, and site-specific background soil concentrations. Table 3A is attached to this memorandum for reference.

The USEPA Region IX PRG values are risk-based soil concentrations that are protective for exposures to analytes in soil at specified target risk levels. The residential soil PRGs are protective for young children and adults who are assumed to ingest and contact soil, and inhale soil-derived dust, during activities such as gardening and playing on the ground, 350 days per year over a 30-year period. The industrial soil PRGs are protective for adults who are assumed to ingest and contact soil, and inhale soil-derived dust, during work-day activities, 250 days per year over a 25-year period. The PRG values used for soil data comparisons in Table 3A are considered to be PRG screening values because they are based on target risks below the EPA threshold risk criteria. Specifically, they are set at an excess lifetime cancer risk (ELCR) of 1 in 1 million ($1x10^{-6}$), which represents the lower bound, or point-of-departure, of the USEPA cancer risk range, and a target hazard index (HI) of 0.1, which represents $1/10^{th}$ the maximum acceptable risk level for non-carcinogenic health effects.

Collectively, the residential soil PRG screening values and site-specific background values are used to select chemicals of potential concern (COPCs). COPCs are the chemicals that could pose more than a negligible risk and are therefore quantitatively evaluated in the risk assessment. According to USEPA Region IV risk assessment guidance, chemicals are selected as COPCs if their maximum detected concentrations are greater than both the USEPA Region IX residential soil PRG screening value and the site-specific background value.

A review of the information presented in Table 3A indicates that seven inorganic analytes were detected at concentrations greater than the residential PRG screening values: aluminum, antimony, arsenic, iron, manganese, thallium, and vanadium. Of these analytes, aluminum, arsenic, and iron were detected at concentrations below the site-specific background values in all of the samples. Based on the soil data collected to date and presented in Table 3A, these three analytes would not be selected as COPCs in a risk assessment. Manganese and thallium were each detected in one sample at a concentration greater than the site-specific background value, and vanadium was detected in two samples at concentrations greater than the site-specific background values. Antimony was not detected in the Site-specific background data set, but the maximum detected concentration in samples collected from the Site is less than the background value for Piedmont soils. These analytes are further discussed in the context screening-level health risks.

Antimony. Antimony was detected at location SS-03-02 at a concentration (5 mg/kg) slightly above the residential soil PRG screening value of 3.1 mg//kg. If it was assumed that children and adults contacted soil at this location almost every day during play and outdoor activities, the HI would be only 0.17, which is well below the USEPA threshold HI of 1. This indicates that antimony at this location does not pose a health risk in excess of USEPA risk limits.

Manganese. Manganese was detected at location SS-02-02 at a concentration (830 mg/kg) above the residential soil PRG screening value of 180 mg/kg. If it was assumed that children and adults contacted soil at this location almost every day during play and outdoor activities, the HI would be only 0.46, which is well below the USEPA threshold HI of 1. This indicates that manganese at this location does not pose a health risk in excess of USEPA risk limits.

Thallium. Thallium was detected at locations SS-07-01-03, SS-08-01-02, and SS-09-01-02 at concentrations ranging from 4.5 mg/kg to 12 mg/kg, which are above the residential soil PRG screening value of 0.52 mg/kg. If it was assumed that children and adults contacted soil at each of these locations almost every day during play and outdoor activities, the HI values would range from 0.86 to 2.3. However, the HI associated with the Site-specific background value of 9.1 mg/kg (a HI of 1.8) is also greater than 1. For all of the soil samples except SS-08-01, the risk associated with exposure to thallium at the background locations is greater than the risk associated with exposure to thallium in samples collected at the Site. For sample SS-08-01, the

incremental risk, which is the risk that is over and above the risk associated with the natural background conditions, is 0.5, which is below the threshold HI of 1. It is notable also that the maximum concentration of thallium in the Site-specific background soil data set (14 mg/kg) is higher than the maximum concentration detected in soil samples collected at the Site. Collectively, this suggests that risks associated with thallium in soil samples collected at the Site are not distinguishable from risks associated with soil samples collected at background locations.

Vanadium. Vanadium was detected at the majority of locations at concentrations above the residential soil PRG screening value of 7.8 mg/kg, ranging from 8.2 mg/kg to 200 mg/kg. If it was assumed that children and adults contacted soil at these locations almost every day during play and outdoor activities, the HI values for all but five of the locations would be below 1. However, the HI associated with the Site-specific background value of 150 mg/kg (a HI of 1.9) is also greater than 1. For all of the soil samples except SS-02-02 and SS-02-05, the risk associated with exposure to vanadium at the background locations is greater than the risk associated with exposure to vanadium in samples collected at the Site. For samples SS-02-02 and SS-02-05, the incremental risk, which is the risk that is over and above the risk associated with the natural background conditions, are HI values of 0.64 and 0.13, respectively, which are below the threshold HI of 1. It is notable also that the there is only one sample collected at the Site with a concentration greater than the maximum detected vanadium concentration in the Site-specific background soil data set (170 mg/kg). Collectively, this suggests that risks associated with vanadium in soil samples collected at the Site are not distinguishable from risks associated with soil samples collected at background locations.

JP

Attachments

Table 3A
AOC Soil Analytical Results vs. Human Health Screening Values
Step 1 RI Implementation
October 2005
Henry's Knob Former Mine Site
York County, South Carolina

Sample ID	Cyanide-Total mg/kg	Aluminum mg/kg	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Calcium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Iron mg/kg	Lead mg/kg	Magnesium mg/kg	Manganese mg/kg	Mercury mg/kg	Nickel mg/kg	Potassium mg/kg	Selenium mg/kg	Silver mg/kg	Sodium mg/kg	Thallium mg/kg	Vanadium mg/kg	Zinc mg/kg
SS-01-01X00XX	< 0.59	4,500	< 0.29	**2.9**	71	< 0.23	< 0.12	< 290	7.8	5.3	78	**48,000**	6.5	< 290	22	< 0.097	< 2.3	< 290	9.0	< 0.29	< 290	< 0.59	**37**	< 7.7
SS-01-02X00XX	< 0.64	710	< 0.32	**4.7**	28	< 0.26	< 0.13	< 320	1.2	1.4	12	**29,000**	1.8	< 320	11	< 0.11	4.4	< 320	1.9	0.55	< 320	< 0.64	**9.6**	< 3.2
SS-01-03X00XX	< 0.52	880	< 0.26	**5.4**	67	< 0.21	< 0.10	< 260	3.6	< 1.4	7.2	**27,000**	2.3	< 260	< 0.78	< 0.086	< 2.1	< 260	10	< 0.26	< 260	< 0.52	**22**	< 2.6
SS-01-04X00XX	< 0.52	880	< 0.26	**1.9**	83	< 0.21	< 0.10	< 260	1.8	< 1.4	9.2	**19,000**	2.6	< 260	4.7	< 0.086	< 2.1	< 260	5.4	< 0.26	< 260	< 0.52	**14**	< 3.0
SS-01-05X00XX	< 0.53	1,000	< 0.26	**1.6**	91	< 0.21	< 0.10	< 260	2.0	< 1.4	5.6	**15,000**	2.2	< 260	6.4	< 0.087	< 2.1	< 260	4.0	< 0.26	< 260	< 0.53	**10**	< 2.7
SS-01-06X00XX	< 0.74	**12,000**	< 0.37	**5.0**	130	0.34	< 0.15	< 370	10	< 1.9	38	**52,000**	17	< 370	40	< 0.12	< 3.0	< 370	9.7	< 0.37	< 370	< 0.74	**74**	< 11
SS-02-01X00XX	< 0.54	2,100	< 0.27	**2.3**	70	< 0.22	< 0.11	< 270	5.5	1.7	15	**19,000**	1.9	< 270	6.6	< 0.09	< 2.2	< 270	5.4	< 0.27	< 270	< 0.54	**27**	4.0
SS-02-02X00XX	< 0.61	**41,000**	< 0.31	**2.8**	44	0.77	< 0.12	< 310	34	29	79	**66,000**	8.4	680	830	< 0.10	9.5	590	3.6	< 0.31	< 310	< 0.61	**200**	31
SS-02-03X00XX	< 0.55	7,100	< 0.28	**2.7**	39	0.22	< 0.11	< 280	9.5	3.3	23	**35,000**	3.3	< 280	43	< 0.092	< 2.2	< 280	6.0	< 0.28	< 280	< 0.55	**59**	5.7
SS-02-04X00XP	< 0.64	**15,000**	< 0.32	**3.7**	66	0.37	< 0.13	< 320	12	< 1.7	30	**50,000**	6.1	< 320	41	< 0.11	< 2.6	360	5.0	< 0.32	< 320	< 0.64	**89**	7.8
SS-02-04X00XX	< 0.64	**17,000**	< 0.32	**4.0**	61	0.42	< 0.13	< 320	13	< 1.6	34	**46,000**	6.9	< 320	49	< 0.10	2.6	410	5.5	< 0.32	< 320	< 0.64	**110**	9.3
SS-02-05X00XX	< 0.68	**32,000**	< 0.34	**6.0**	81	0.67	< 0.14	< 340	21	< 1.8	832	**66,000**	12	< 340	68	< 0.11	4.8	570	7.2	< 0.34	< 340	< 0.68	**160**	17
SS-03-01X00XX	< 0.63	**15,000**	< 0.31	**4.5**	23	0.36	< 0.12	< 310	22	1.7	44	**60,000**	6.1	< 310	88	< 0.10	2.5	550	146.8	< 0.31	< 310	< 0.63	**130**	19
SS-03-02X00XX	< 0.50	1,600	**5.0**	**1.5**	60	< 0.20	< 0.10	< 250	0.88	< 1.3	7.2	**14,000**	50	< 250	8.2	< 0.084	< 2.0	< 250	43.6	< 0.25	< 250	< 0.50	**20**	< 3.1
SS-03-03X00XX	< 0.56	**16,000**	< 0.28	**5.1**	140	0.30	< 0.11	< 280	11	< 1.5	43	**58,000**	15	< 280	33	< 0.093	2.6	340	26.9	< 0.28	< 280	< 0.56	**58**	14
SS-05-01X00XX	< 0.54	J 1,400	J< 0.27	**2.4**	J 87	< 0.22	< 0.11	< 270	0.99	< 1.4	6.3	**21,000**	5.0	< 270	1.5	< 0.090	< 2.2	J 430	6.0	< 0.27	< 270	J< 0.54	**10**	6.2
SS-05-02X00XX	< 0.61	J **14,000**	J< 0.30	**4.9**	J 58	0.32	< 0.12	< 300	14	< 1.6	37	**53,000**	6.0	< 300	34	< 0.10	2.9	J 300	6.0	< 0.30	< 300	J< 0.61	**110**	9.7
SS-05-03X00XD	< 0.52	J 450	J< 0.26	**1.6**	J 130	< 0.21	< 0.10	< 260	0.51	< 1.4	2.2	**8,400**	1.4	< 260	< 0.79	< 0.087	< 2.1	< 260	2.8	< 0.26	< 260	J< 0.52	**3.7**	< 2.6
SS-05-03X00XX	< 0.54	J 440	J< 0.27	**1.4**	J 120	< 0.22	< 0.11	< 270	0.48	< 1.4	2.0	**9,800**	1.2	< 270	< 0.81	< 0.090	< 2.2	< 270	2.5	< 0.27	< 270	J< 0.54	**3.2**	< 2.7
SS-05-04X00XX	< 0.52	J 980	J< 0.26	**2.0**	J 160	< 0.21	< 0.10	< 260	0.84	< 1.4	6.5	**22,000**	2.5	< 260	< 0.79	< 0.087	< 2.1	< 260	5.1	< 0.26	< 260	J< 0.52	**8.2**	3.0
SS-05-05X00XX	< 0.52	J 1,000	J< 0.26	**1.4**	J 66	< 0.21	< 0.10	< 260	1.3	< 1.4	4.0	**9,800**	1.8	< 260	2.4	< 0.086	< 2.1	< 260	3.8	< 0.26	< 260	J< 0.52	**8.6**	< 2.6
SS-07-01X00XX	< 0.52	J 740	J< 0.26	**1.9**	62	< 0.21	< 0.10	< 260	2.0	< 1.4	5.8	**22,000**	2.3	< 260	J 2.6	< 0.086	< 2.1	< 260	4.6	< 0.26	< 260	4.5	**9.8**	< 2.6
SS-07-02X00XX	< 0.53	J **10,000**	J< 0.26	**3.0**	20	0.36	< 0.11	< 260	6.1	4.0	30	**31,000**	3.6	J 660	J 130	< 0.088	4.0	J 480	6.7	< 0.26	< 260	7.1	**33**	J 5.5
SS-07-03X00XX	< 0.52	2,700	< 0.26	**3.9**	110	0.25	< 0.10	280	4.5	1.5	15	**48,000**	8.6	< 260	42	< 0.086	2.4	< 260	8.1	< 0.26	< 260	14.8	**36**	< 2.6
SS-08-01X00XX	< 0.54	J **7,900**	J< 0.27	**3.2**	38	0.47	< 0.11	290	4.8	< 1.4	27	**35,000**	2.9	< 270	J 53	< 0.089	3.6	< 270	6.2	< 0.27	< 270	18.8	**35**	< 2.7
SS-08-02X00XX	< 0.53	J **8,260**	J< 0.26	**3.8**	58	0.31	< 0.10	< 260	3.9	< 1.4	26	**52,000**	2.7	< 260	J 36	< 0.088	2.5	< 260	8.9	< 0.26	< 260	11.2	**36**	< 2.6
SS-09-01X00XX	< 0.56	J **13,000**	J 3.0	**5.7**	76	0.30	< 0.11	820	16	1.6	73	**35,000**	120	J 460	J 130	0.46	15	J 480	4.5	< 0.28	< 280	16.8	**36**	160
SS-09-02X00XD	< 0.66	J **29,000**	J< 0.33	**4.0**	33	0.66	< 0.13	< 330	12	< 1.7	35	**48,000**	11	J 2,600	J 88	< 0.11	5.6	J 510	5.0	< 0.33	< 330	8.0	**71**	J 16
SS-09-02X00XX	< 0.66	J **15,000**	J 0.44	**3.5**	25	0.52	< 0.13	< 330	11	< 1.7	32	**59,000**	9.9	J 460	J 35	< 0.11	4.9	J 420	4.9	< 0.33	< 330	9.1	**66**	J 6.7
Maximum Detected Value (AOCs)	ND	**41,000**	**5.0**	**6.0**	160	0.77	ND	1820	34	29	183	**68,000**	120	2,600	**830**	0.46	15	570	9.9	0.55	ND	12	**1200**	160
Two Times Arithmetic Mean (Background)	ND	47,610	ND	9.3	89	0.9	ND	430*	54	6.9	80	73,981	17	599	348	ND	9.5	1,083	3.8	1.60	ND	9.1	150	31
Region IX Residential PRGs HQ=0.1	120	7,600	3.1	0.39c	540	15	3.7	nutrient	210c	140nc*	310	2,300	400	nutrient	180	2.3	160	nutrient	39	39	nutrient	0.52	7.8	2,300
Region IX Industrial PRGs HQ=0.1	1,200	10,000	41	1.6c	6,700	190	45	nutrient	450c	1300nc*	4,100	10,000	800	nutrient	1,900	31	2,000	nutrient	510	510	nutrient	6.7	100	10,000
Maximum Detected Background Value	ND	48,000	ND	17	150	1.0	ND	430	120	14	160	78,000	20	730	2,500	ND	11	1,100	5.1	1.30	ND	14	170	33
Piedmont Background Soil Concentrations[1]	1[2]	32,695	6[2]	18	68	0.6[2]	1[2]	928[2]	38	5[2]	16	32,412	15.1[2]	2,529	288	0.23[2]	10.4	2,843	1[2]	5[2]	256[2]	86	NE	39

Note:

results expressed in mg/kg (milligram per kilogram)
< less than (not detected)
J estimated value
AOCs Areas of Concern
* maximum value
2.9 **value exceeds Region IX PRG (See Table 7)**
91 value exceeds Two Times Arithmetic Mean (Background) (See Table 2)
120 **value exceeds both Region IX PRG and Two Times Arithmetic Mean (Background)**
ND not detected in background samples
nc* risk-based value associated with a HQ=0.1 is lower than the risk-based value associated with a 1E-06 cancer risk
nutrient element is considered a macronutrient
1 Table 2 Upper Confidence Limit *Piedmont Soils (Elements in South Carolina Inferred Background Soil and Stream Sediment Samples*, SC Geology, 1999. v41, p. 11-25)
2 Table 2 Upper Confidence Limit *State Wide Soils (Elements in South Carolina Inferred Background Soil and Stream Sediment Samples*, SC Geology, 1999. v41, p. 11-25)

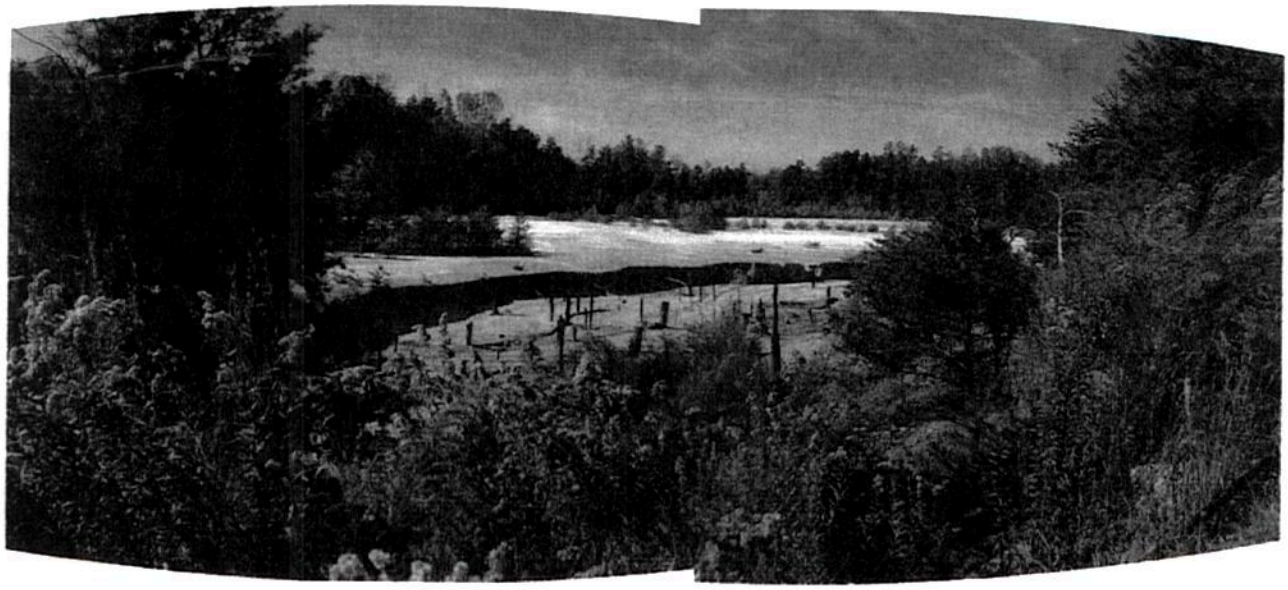
1.92308

Created by: BC
Checked by: JPC

United States
Environmental Protection Agency

Henry's Knob Former Mining Site
Community Information Update

Clover, York County, South Carolina — March 2008



Tailings—Henry's Knob Former Mining Site, Clover Township, South Carolina

US Environmental Protection Agency Region 4 (EPA) representatives will be interviewing local residents in conjunction with the environmental investigation of the Henry's Knob Former Mining Site in Clover Township, South Carolina. These informal interviews, which are part of EPA's community involvement activities, are designed to help community members and the EPA work together to address environmental concerns. For more information, contact EPA community involvement coordinator Linda Starks at 1-800-435-9233.

Opportunities for Community Involvement

Community Interviews
March 5, 6, and 7, 2008

Save the date!
Community Meeting
April 17, 2008

The EPA is also planning a community meeting in the Clover area for April 17, 2008, to present sampling results and talk about next steps in the cleanup process at the Henry's Knob site. Save the date and watch for details about the April 17 meeting in your local newspaper or receive more information by calling EPA community involvement coordinator Linda Starks at 1-800-435-9233.

Site Background

The Henry's Knob Site is located at the corner of Henry's Knob Road and State Highway 55 in the township of Clover, which is adjacent to the city of York, South Carolina. The 185-acre site was an open pit kyanite mine that operated from 1947 to 1970.

The site was deeded to York County in 1974 and used as a park. York County sold the property in 1982, and the site has been privately owned since that time.

Approximately 450 residences in this area rely on private wells for their drinking water. Current census data for York County indicates there are 2.72 people per household, which means approximately 1,224 people within the groundwater area are using private wells impacted by the Henry's Knob site.

In March 2000, Katawba Environmental conducted Phase I and Phase ll studies of the Henry's Knob site. Samples collected during the Katawba study revealed levels of barium, chromium, cobalt, magnesium, nickel, and zinc in the site's groundwater. Of these heavy metals, cadmium and lead were above the EPA's Risk Based Concentrations (RBCs) for groundwater. Cadmium and lead were above EPA Maximum Contaminant Levels (MCLs).

Surface soil samples indicated elevated levels of arsenic, barium, chromium, copper, cobalt, magnesium, nickel, lead, zinc and mercury, with arsenic above RBCs. Surface water collected from the mine pit indicated elevated levels of chromium, copper, cobalt, magnesium, nickel, and zinc. Sediment samples collected from the pit had levels of arsenic, barium, chromium, copper, and lead that exceeded laboratory detection limits.

In August 2004, the EPA and Combustion Engineering, the potentially responsible party for cleaning up the Henry's Knob site, negotiated a formal agreement called an Agreement on Consent or AOC for the site.

Cleanup Progress: No Construction Underway As Yet

More recently, potentially responsible parties (PRPs) prepared a Remedial Investigation/ Feasibility Study Work Plan. The EPA and the South Carolina Department of Health and Environmental Control (SC DHEC) reviewed and approved the Work Plan. This approved document, dated September 23, 2005, determined the path of investigations for the site in accordance with state and federal requirements.

The overall remedial investigation (RI) was phased, and the Work Plan presented the first step of the investigation. This phase of the RI was a thorough and comprehensive sampling of soils, tailings, sediments and surface water. In April 2006, the PRPs submitted a report to EPA entitled, "Step l Remedial Investigation Technical Memorandum." The report contained the results of the Phase l investigation and outlined plans for the next phase of sampling and analysis, which will include the installation of monitoring wells and sampling of the groundwater. EPA reviewed the Step 1 report and provided comments, which will be incorporated into the PRPs' final document.

In November 2007, the PRPs submitted a "Step 2 Remedial Investigation Technical Memorandum." The report focused on residential and groundwater monitoring at the site. EPA will review the technical memorandum and provide comments to the PRPs. A public meeting will then be conducted April 17, 2008, to inform the community of its findings.

EPA also reviewed the residential well sampling data in the report and recommended that an alternate drinking water system be provided to property owners whose wells showed substances above recommended levels. The PRPs are now providing bottled water to six property owners.

For More Information

U.S. Environmental Protection Agency contacts:

U.S. EPA Region 4
Superfund Remedial & Site Evaluation Branch
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Linda Starks, Community Involvement Coordinator
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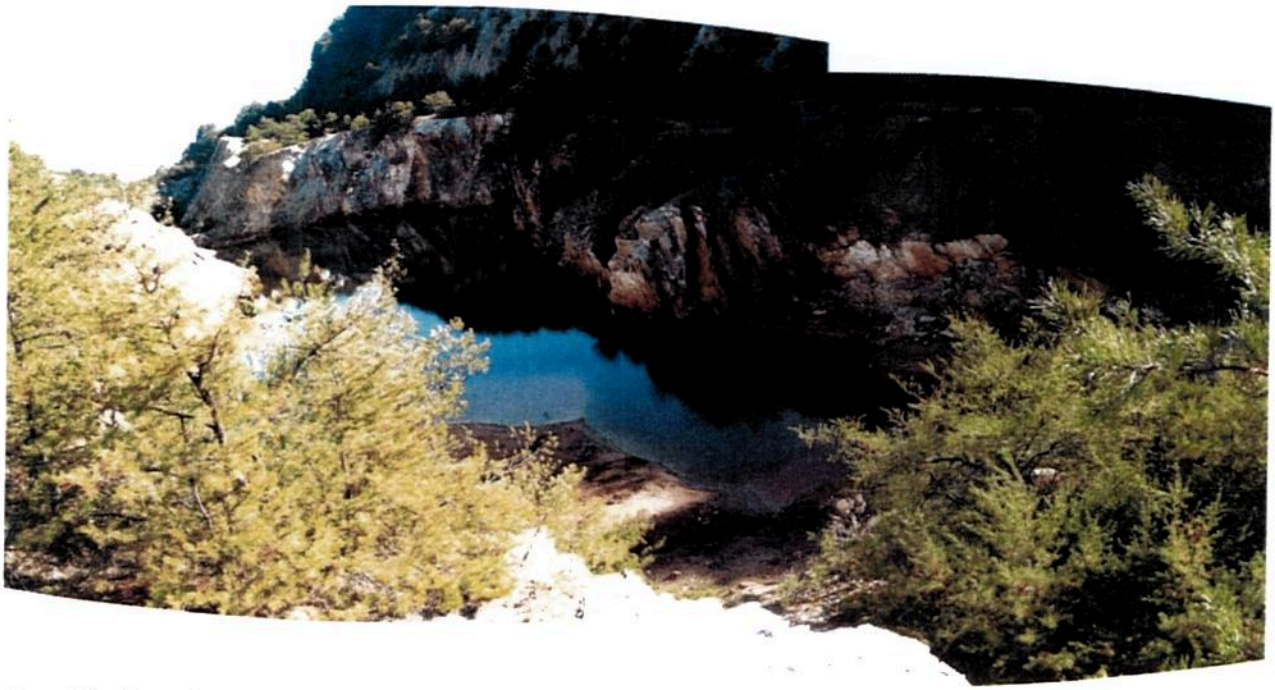
starks.linda@epa.gov

SITE: Henry's Knob
BREAK: 13.9
OTHER: v.1

United States
Environmental Protection Agency

Henry's Knob Former Mining Site
Community Information Update

Clover, York County, South Carolina — April 2008



Open Pit—Henry's Knob Former Mining Site, Clover Township, South Carolina

EPA hosts community meeting on April 17 at Bethany Elementary School

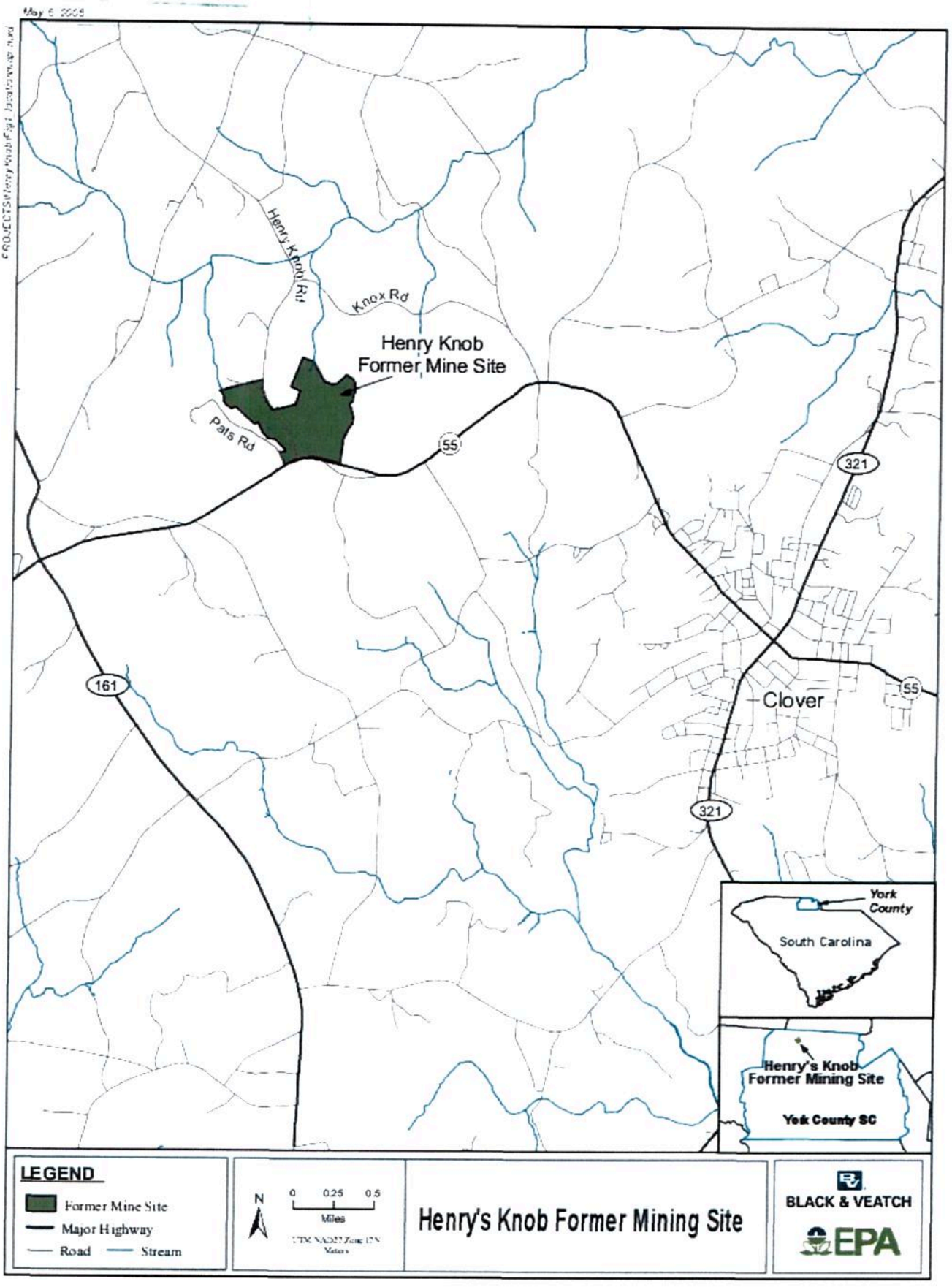
Representatives of the United States Environmental Protection Agency Region 4 (EPA), in cooperation with the South Carolina Department of Health and Environmental Control (DHEC), invite Clover area residents and others interested in the Henry's Knob Former Mining Site to a community update meeting on April 17, beginning at 7:00 p.m. at Bethany Elementary School, 337 Maynard Grayson Road, in Clover.

The meeting agenda includes an overview of site activities, such as the cleanup process, schedule, and community involvement opportunities, as well as recent site investigation results and next steps. Everyone is welcome.

Community interviews held in March; EPA listens to residents' concerns

EPA representatives visited the Clover area in March 2008 to view site conditions, interview a cross-section of local residents about their interest in the Henry's Knob site, and to hear any concerns they may have about past, present, or future site activities. In one-on-one, informal conversations with several local residents, EPA representatives became more familiar with the community around the site, concerns residents have about the site, and other community issues that affect them.

Community interviews are one way that EPA representatives become acquainted with residents in communities on or near Superfund sites.


Henry Knob Rd
Knox Rd
Henry Knob
Former Mine Site
Pals Rd
55
321
161
Clover
55
321
York
County
South Carolina
Henry's Knob
Former Mining Site
York County SC
LEGEND
Former Mine Site
Major Highway
Road
Stream
N
0 0.25 0.5
Miles
Henry's Knob Former Mining Site
BLACK & VEATCH
EPA

Community Involvement—An Important Part of the Superfund Process

Community involvement is the process of engaging in dialogue and collaboration with community members. The goal of Superfund community involvement is to advocate and strengthen early and meaningful community participation during Superfund cleanups. Superfund community involvement staff strive to:

- Keep the community well informed of ongoing and planned activities.
- Encourage and enable community members to get involved.
- Listen carefully to what the community is saying.
- Take the time needed to deal with community concerns.
- Change planned actions where community comments or concerns have merit.
- Explain to the community what EPA has done and why.

These are the goals the EPA, in cooperation with DHEC, seeks to accomplish at the Henry's Knob site.

EPA Local Information Repository for the Henry's Knob Site

Clover Branch Library
107 Knox St.
Clover, SC 29710

Upcoming Site Activities

ABB is now preparing its plans for Step 3 of the investigation, which will take place in the summer of this year. Step 3 will involve more surface and groundwater sampling in and around the site.

Final RI/FS Report.

ABB will conduct additional sampling to fill data gaps and complete the RI. The EPA and DHEC will comment on the draft RI report, and ABB will prepare a final report. The Final RI Report will describe site investigations and evaluate both the fate and transport of contaminants from the site and potential risks to human health and the environment posed by site contaminants.

In addition, ABB will complete a feasibility study (FS), which will identify and evaluate possible alternatives to reduce unacceptable risks associated with the Henry's Knob site. After EPA and DHEC review of the draft FS report, ABB will prepare the final report. EPA expects the Final FS Report in late 2009/early 2010.

When the RI/FS is completed, the EPA will issue a Proposed Plan to address the environmental conditions at the site. EPA also will hold a public meeting to present the plan and provide an opportunity for public comment. The EPA will hold a 30-day comment period, review all comments received, and issue a Record of Decision (ROD). The ROD is anticipated for Spring 2010.

Community members with questions or concerns about site activities are encouraged to contact any of the site representatives listed on the back page of this update, or stop by the Clover Public Library to view site documents.

For More Information

EPA Contacts

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